Effects of Set-Aside Land on Farmland Biodiversity: Comments on Van Buskirk and Willi

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Introduction

Worldwide, wildlife in agricultural landscapes is experiencing significant declines in range and population size (e.g., Donald et al. 2001). In the past century, expansion and intensification of agriculture have resulted in spectacular increases in crop yields but have also resulted in habitat destruction, making agricultural landscapes increasingly hostile to farmland wildlife. In Europe and the United States both consequences of modern agriculture have resulted in policy responses. Set-aside schemes have been introduced, initially in attempts to reduce overproduction and the soaring costs of price support and storage, but later also for biodiversity conservation aims (Ervin 1992; Floyd 1992). In Europe agri-environment schemes were initiated with the specific aim of counteracting negative effects of modern agriculture on the environment. In the long run the significant expenditures associated with these schemes can be justified only if scientific evaluations indicate that their objectives are being met (Pullin & Knight 2000).

Van Buskirk and Willi (2004) evaluated the biodiversity benefits of set-aside land in North America and Europe with a meta-analysis approach. They present clear, overall biodiversity increases and found positive relationships between biodiversity and age and area of set-aside land. Based on these results, they conclude that agri-environmental policies are effective and recommend that greater amounts of land should be set aside regionally in Europe and North America to maximize biodiversity benefits.

We think that the design and geographic distribution of the study of Van Buskirk and Willi were inadequate for studying the ecological benefits of agri-environmental policies in Europe and North America and, as a result, their conclusions may be invalid. We suggest that all major set-aside and particularly agri-environment schemes should be rigorously evaluated within the geographic, agronomic, and socioeconomic context of individual countries where the schemes are implemented.

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Van Buskirk and Willi Study Design

The original meaning of set-aside land is arable land taken out of production (Clarke 1992; this meaning of set-aside land will be used henceforth). Van Buskirk and Willi define set-aside land as "all or part of a field subjected to, for at least one growing season, low or no fertilizer or chemical inputs, low or no grazing or tillage, and mowing no earlier than late June, if at all, with vegetation either naturally regenerated or sown at the beginning with grass or wildflower mixtures." Based on this definition, they included studies examining the effects of agricultural extensification (e.g., Smith et al. 1997), different cropping systems (e.g., Andreasen et al. 1996), and agri-environment schemes (e.g., Peter & Walter 2001) on both grasslands and arable fields, in addition to studies examining the effects of set-aside schemes in the strict sense (e.g., Best et al. 1998).

Their definition is confusing and results in methodological problems. The primary objectives of set-aside schemes and agri-environment schemes differ, as mentioned previously. Furthermore, whereas the prescriptions of set-aside schemes are more or less uniform across Europe and North America, the exclusively European agri-environment schemes cover a broad spectrum of very different measures (Kleijn & Sutherland 2003). The effects of schemes may differ with type of scheme (e.g., Kleijn et al. 2001 versus Peach et al. 2001), region (Chown 1998), and species (Bradbury & Allen 2003).

Schemes, scheme age, land-use intensity, and country are autocorrelated. (i.e., certain schemes are implemented only in certain countries that have a particular land-use intensity). Furthermore, not all countries contributed the same number of studies. Thus, not taking into account the differences in the schemes that were studied results in an unbalanced study design with effect size estimates that are not independent (Gurevitch & Hedges 1999). This violates one of the assumptions of meta-analysis and makes it impossible to draw unequivocal conclusions from the results. For example, the differences between countries may result from differences in land-use intensity as the authors claim. Alternatively, they may be caused by the fact that schemes evaluated in some countries were ineffective, whereas those examined in other countries were effective. Similarly, the negative relationship between set-aside age and bird abundance may be a valid result, but it could also derive from studies of older sites having examined one scheme (e.g., meadow bird agreements in the Netherlands; Kleijn et al. 2001) and studies of younger sites having examined another scheme (e.g., rotational set-aside in the United Kingdom; Henderson et al. 2000). By ignoring the differences between the various schemes and by providing no information on correlations between variables, Van Buskirk and Willi have made it impossible to distinguish the effects of their predictive factors from that of other factors (e.g., scheme type, country, habitat type). As a result, their conclusions may be incorrect.

Geographic Representation of Studies

Eighty-two percent of the studies used in Van Buskirk and Willi's meta-analysis are from just four countries. In Europe only 11 of the 44 countries were represented, with 80% of the studies coming from the United Kingdom, Germany, and Switzerland, covering only 6% of the continent. Studies from Mediterranean countries, Central and Eastern European countries, and mountainous areas are virtually absent. Thus, the study of Van Buskirk and Willi is almost exclusively based on data collected in intensively farmed areas. Both biodiversity levels and the potential outcome of conservation measures are expected to vary with farming intensity (Donald et al. 2001; Kleijn & Sutherland 2003). Nevertheless van Buskirk and Willi draw conclusions and make recommendations about agri-environmental policy for the whole of Europe and North America.

In many of the countries not examined by Van Buskirk and Willi, and even in agriculturally marginal areas of Germany, France, and Switzerland, agricultural land abandonment is one of the biggest threats to farmland biodiversity (MacDonald et al. 2000; Suárez-Seoane et al. 2002; Laiolo et al. 2004). For instance, the primary objective of the French agri-environment program is to combat land abandonment in such areas (Buller & Brives 2000). In Eastern Europe the recent political changes have had a major impact on the agricultural sector. On good agricultural land a rapid intensification is anticipated, with the associated rapid decline in biodiversity that was previously observed in Western Europe (EEA 2004*a*). Marginal lands are often abandoned (EEA 2004*a*; Hoffmann et al. 2004). In Hungary 5–10% of arable fields remained uncultivated in the seasons from 1999 to 2003 (Hungarian Central Statistical Office 2004). In Estonia 25% of arable land and 56% of permanent grasslands have been abandoned since the early 1990s (EEA 2004*b*). In a number of Central and Eastern European countries, the number of grazing livestock declined sharply between 1990 and 2003, threatening the persistence of 70,000 km^2 seminatural grasslands in this area (EEA 2004*a*).

The irony is that in these countries, as well as in marginal areas elsewhere, biodiversity levels are still high. Many endangered farmland species have their strongholds in these areas (Donald et al. 2001, 2002; EEA 2004*a*, 2004*b*) and depend on continued extensive agricultural activities for their persistence. Abandonment of these areas results generally in a decline in farmland biodiversity and a replacement of endangered farmland species by more common forest species (Laiolo et al. 2004; Verhulst et al. 2005) or, worse, invasive exotic species (Weber 2001; Mihály & Demeter 2003) as succession progresses.

Land abandonment is covered by the confusing definition of *set-aside* used by Van Buskirk and Willi. Recommending set-asides as a policy to combat the decline in European farmland biodiversity, as is done by Van Buskirk and Willi, would thus be counterproductive in these areas.

Conclusions

Van Buskirk and Willi claim that their meta-analysis unequivocally resolves the controversy about the biodiversity benefits of set-aside land. There has never been, however, a controversy about the beneficial ecological effects of taking intensely farmed arable land out of production (Clarke 1992). There is currently a debate on the ecological effectiveness of agri-environment schemes, which is the debate referred to by Van Buskirk and Willi (e.g., Kleijn et al. 2001; Hoogeveen et al. 2002; Kleijn & van Zuijlen 2003). Agri-environment schemes address a wide range of habitats such as grasslands, dehesas, hedges, and stone walls. They are pivotal to European agri-environmental policy. In 2003 they were implemented on more than 20% of European Union (EU) farmland. Since 1994, total EU expenditures have amounted to c. €24.3 billion (EEA 2002). Agri-environment programs are currently

being prepared or introduced in the 10 Central and Eastern European countries that joined the EU in 2004. Suggesting that these schemes are universally effective, based on a meta-analysis that predominantly analyzed the effects of taking arable land out of production, is wrong and gives a misleading message to scientists and policy makers.

In contrast to North America, agricultural land use has been the predominant form of land use in Europe for many centuries (Dieterich & Van der Straaten 2004). Many plant and animal species adapted to and thrived in the small-scale mixture of extensively managed arable fields, grasslands, heather fields, and forests. The absence of typical North American farmland species may explain the positive response of endangered birds to land taken out of production that van Buskirk and Willi observed because this produced habitat more similar to their native habitat than arable land. In Europe the effects of agricultural policies on farmland wildlife are more complex, first, because the policies are more complex and, second, because many species need at least some agricultural activities for their persistence.

By lumping different types of agri-environmental policy instruments together, the meta-analysis of Van Buskirk and Willi does not take these complexities into account. Consequently, their results are open to different interpretations, and they may have drawn the wrong conclusions. Even if their results are correct, their conclusions cannot be applied to the areas that host most farmland biodiversity in Europe because their meta-analysis was based on studies done almost exclusively in species-poor, intensively farmed areas. We therefore stress the importance of all major set-aside and particularly agri-environment schemes being rigorously evaluated within the geographic, agronomic, and socioeconomic context of individual countries where the schemes are implemented.

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